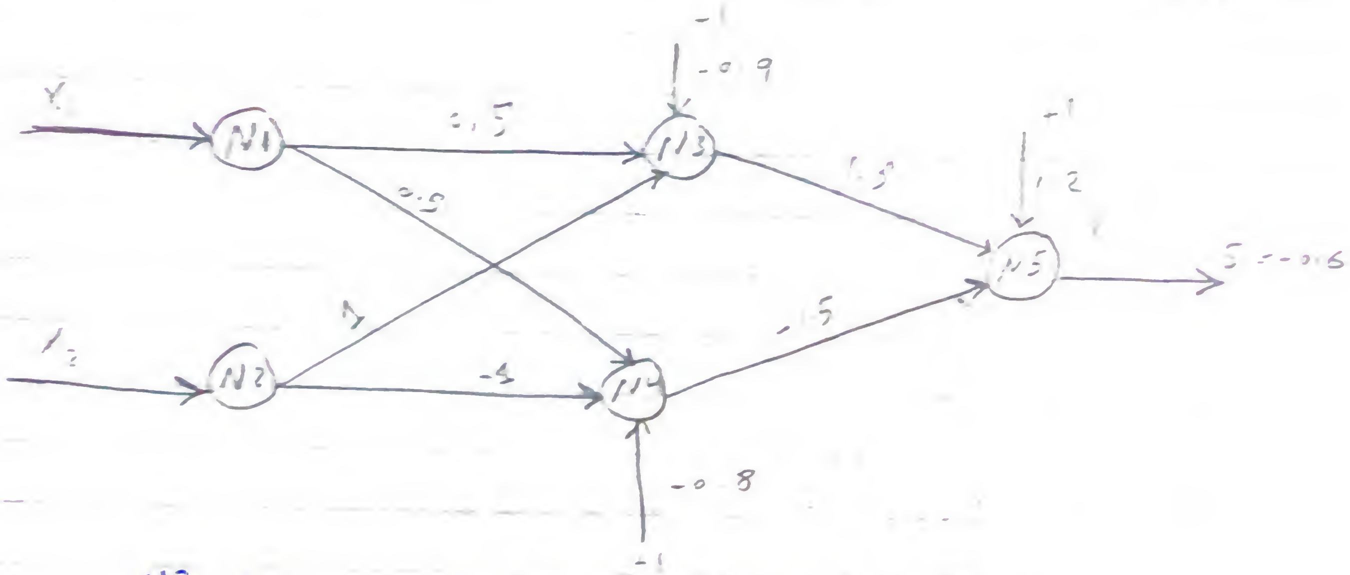


N3, N4 ⟶ binary Sigmoid
N5 ⟶ bipolar Sigmoid
output (N_4) = 2 output (N_3)

} find x_1 ; x_2

$S = -0.6 = g(y_5)$

$$y_5 = \ln\left[\frac{1+g(y_5)}{1-g(y_5)}\right] = -1.386$$

$y_5 = 1.5\, f(y_3) - 1.5\, f(y_4) - 1.2$

$\quad = 1.5\, f(y_3) - 1.5\,(2\, f(y_3)) - 1.2$

$f(y_3) = 0.124$

$f(y_4) = 2 * 0.124 = 0.248$

$$y_3 = \ln\left(\frac{f(y_3)}{1-f(y_3)}\right) = -1.955$$

$$y_4 = \ln\left(\frac{f(y_4)}{1-f(y_4)}\right) = -1.109$$

$y_3 = x_1(0.5) + x_2 - 0.9 = -1.955$

$0.5\, x_1 + x_2 = -1.055$ (1)

$0.5x_1 - x_2 = -0.369$ ②

$x_1 = -1.364 \quad \Rightarrow x_2 = -0.373$

new sheet

① $h(\alpha x) = \tanh(\alpha x)$

$\alpha \Rightarrow$ positive parameter

a) $h(\alpha x) = \dfrac{2}{1+e^{-2\alpha x}} - 1$

b) $\dfrac{d}{dx}\left[h(\alpha x)\right] = \alpha\left[1-h^2(\alpha x)\right]$

c) $\dfrac{d}{dx}\left[h(\alpha x)\right]_{max} = \alpha \longrightarrow x = 0$

d) $\dfrac{d^2}{dx^2}\left[h(\alpha x)\right] = -2\alpha^2 h(\alpha x)\left[1-h^2(\alpha x)\right]$

a) $h(\alpha x) = \dfrac{\sinh(\alpha x)}{\cosh(\alpha x)} = \dfrac{(e^{\alpha x}-e^{-\alpha x})/2}{(e^{\alpha x}+e^{-\alpha x})/2} * \dfrac{e^{-\alpha x}}{e^{-\alpha x}}$

$= \dfrac{1-e^{-2\alpha x}}{1+e^{-2\alpha x}} = \dfrac{2}{1+e^{-2\alpha x}} - \dfrac{1+e^{-2\alpha x}}{1+e^{-2\alpha x}} = \dfrac{2}{1+e^{-2\alpha x}} - 1$

b) $\dfrac{d}{dx}\left[h(\alpha x)\right] = \dfrac{d}{dx}\left[\tanh(\alpha x)\right] = \alpha \operatorname{sech}^2(\alpha x)$

$= (1-\tanh^2(\alpha x))\,\alpha = \alpha\left[1-h^2(\alpha x)\right]$

c) $= \dfrac{d}{dx}(h(\alpha x))\Big|_{max}$ ~~$\Rightarrow$ $\dfrac{d}{dx}\tanh$~~

$= \dfrac{d^2}{dx^2}\left[\tanh(\alpha x)\right] = \dfrac{d}{dx}\left[\alpha(1-\tanh^2(\alpha x))\right]$

$= \alpha\left(-2\alpha \tanh(\alpha x)\operatorname{sech}^2(\alpha x)\right)$

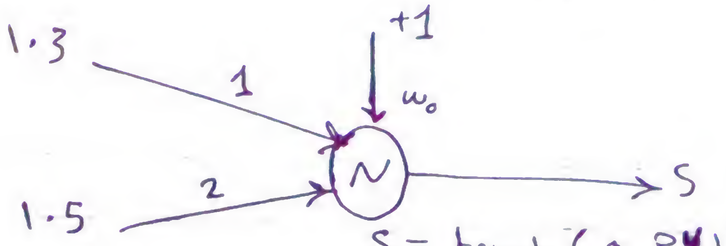
$\Rightarrow -2\alpha^2 \tanh(\alpha x)\operatorname{sech}^2(\alpha x) = 0$

① ال α موجبة و sech عارف، رسمتها أ بسرعة
يبقى tanh . يصفر

$\tanh(\alpha x) = 0 \Rightarrow x = 0$

$\frac{d}{dx}\tanh(\alpha x) = \alpha\, sech^2(\alpha x)\Big| = \alpha\, sech^2(0) = 1\alpha$ (with $sech^2(0) = 1$)

~~max at $\alpha = 1$~~ max

② 

$S = \tanh(0.8y)$

① $w_0 = -2.5$; get S

② $S = 0.71$; get w_0

$y = 1.3 + 3 + w_0 = 4.3 + w_0$

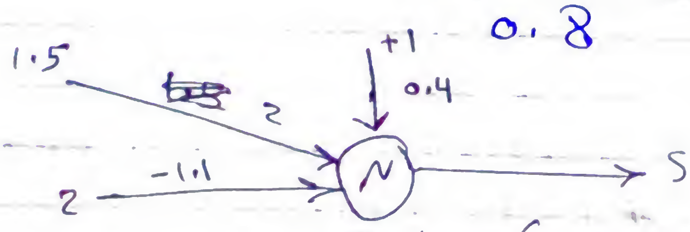
a) $w_0 = -2.5$

$y = 4.3 - 2.5 = 1.8$

$\Rightarrow S = \tanh(0.8(1.8)) = 0.894$

b) $y = \tanh^{-1}(0.71) / 0.8 = 4.3 + w_0 = 1.109$

$w_0 = -4.3 + \frac{\tanh^{-1}(0.71)}{0.8} = -3.191$

[3] 

$S = \tanh(0.75y)$

a) $S = \tanh(0.75)y$

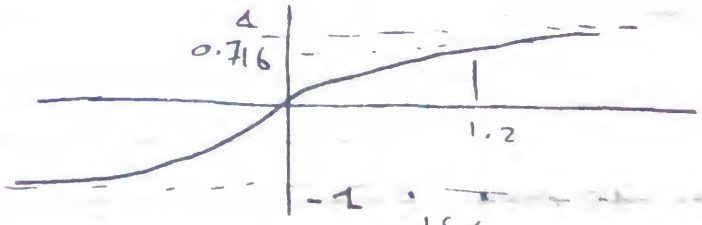
$y = 1.2 \Rightarrow S = \tanh(0.7 \times 1.2) = 0.716$

b) $\frac{dS}{dy} = \alpha\, sech^2(\alpha y) = 0.75\, sech^2(0.75 \times 1.2)$

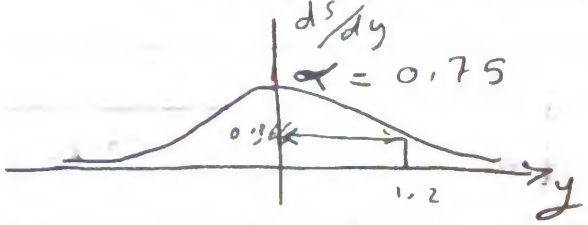
$= 0.366$

c) "S".

y	-2.5	-2	----
S	-0.954	-0.905	----



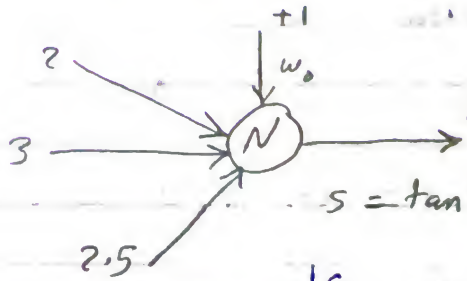
d) $\frac{dS}{dy}$



e) max ⟶ y

at y = 0 max = α ⟶ max = 0.75

[4]



(f) w_0 at $\frac{dS}{dy} = 0.226$

Find y, S

$y = -3.4 + w_0$

$\frac{dS}{dy} = \alpha \operatorname{sech}^2(\alpha y) = 0.5 \operatorname{sech}^2(0.5y) = 0.226$

$= 0.5\,(1 - \tanh^2(0.5y))$

$\tanh(0.5y) = \sqrt{0.548} = \pm 0.74$

$y = \pm 1.9$; $w_0 = \begin{cases} +5.3 \\ +1.5 \end{cases}$

$S = \tanh(\pm 1.9 \times 0.5) = \pm 0.74$